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CanMETOP modeling of Hexachlorobenzene- a progress in 2007

Jianmin Ma, Yi-Fan Li, Cindy Yang

Environment Canada

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Environment Canada Environnement Canada

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Last Chicago BTS meeting

What do we do next?

- More reliable emission data, accounting for historical agricultural application of HCB accumulated in North America soils
- Run CanMETOP with high spatial resolution (24km x 24km) using new emission inventory
- Run and integrate CanMETOP with low resolution (35km x 35km) using historical emission inventory from the 1970s through 2000s
- Tracking North America sources of HCB over the GL

Task 1

Update emission and soil residues from historical pesticides application

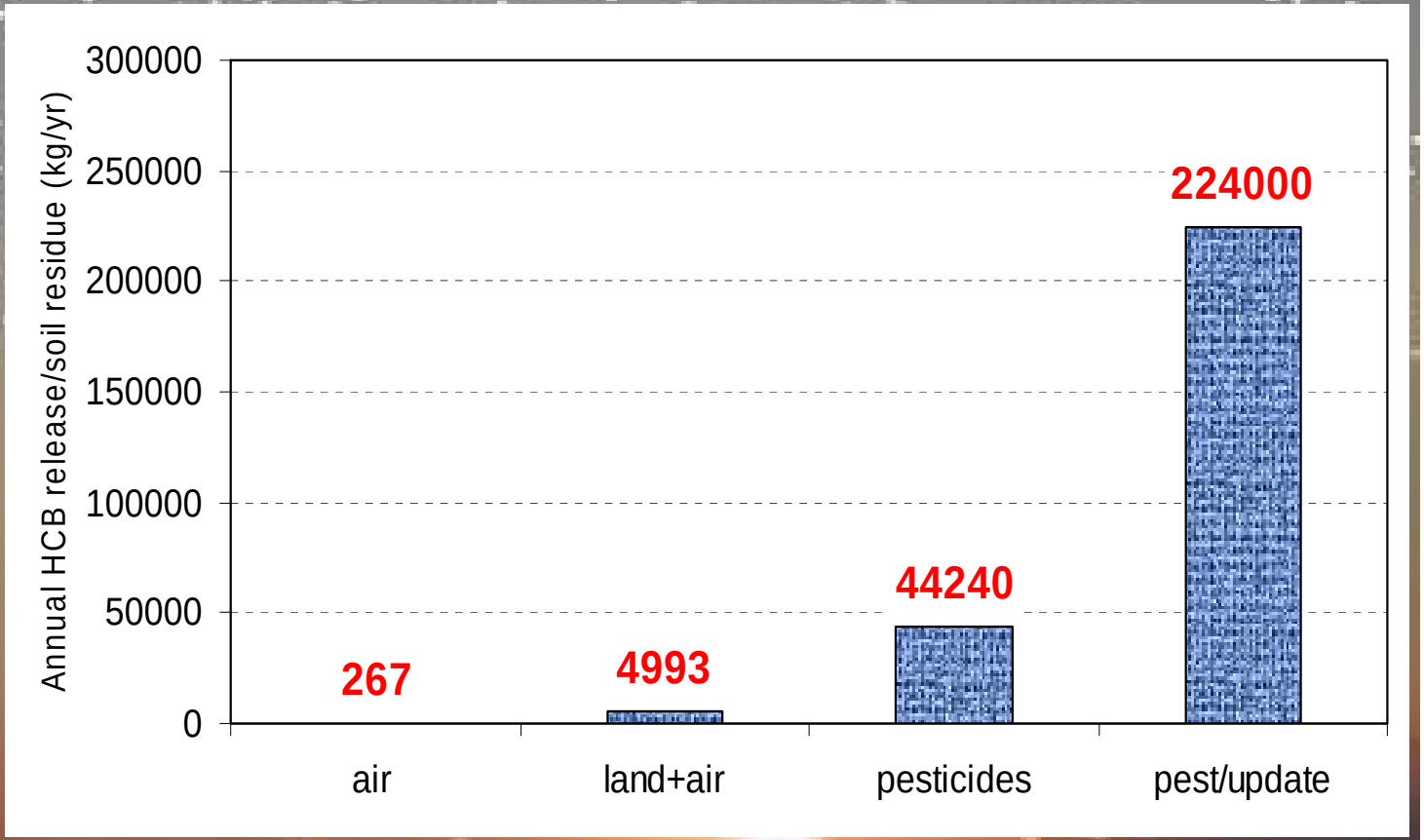
Global amount of HCB in soils in 2000

ton	Half-life (yr)
1170	2.7
5410	5.7
17000	11.7

-Jonathan et al, 2005

Canada and US in 2000

241 ton



Annual air/land release of HCB in the US from USEPA TRI emission inventory and annual soil residue of HCB in the US and Canada from historical pesticides application in 2001 (Unit: kg yr^{-1})

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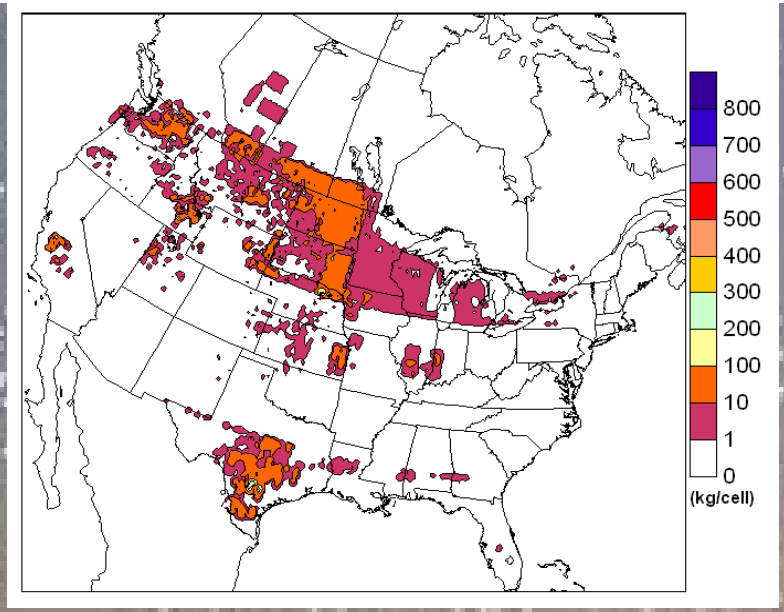
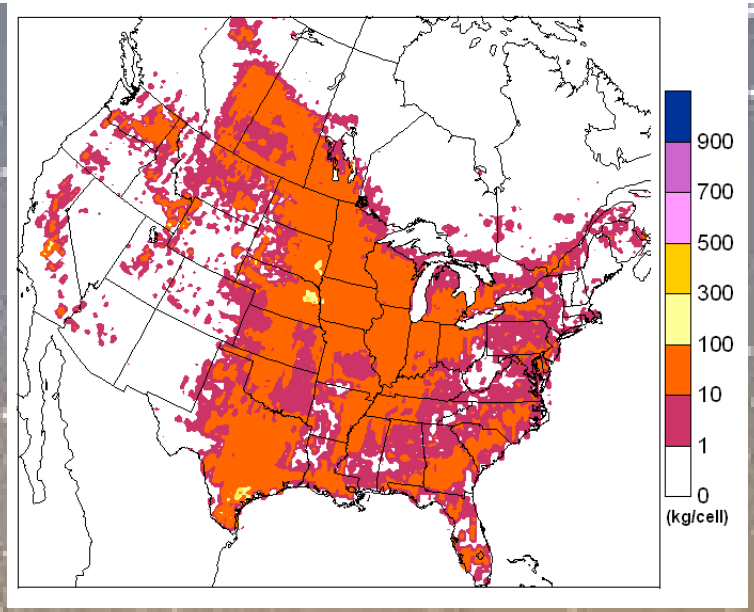
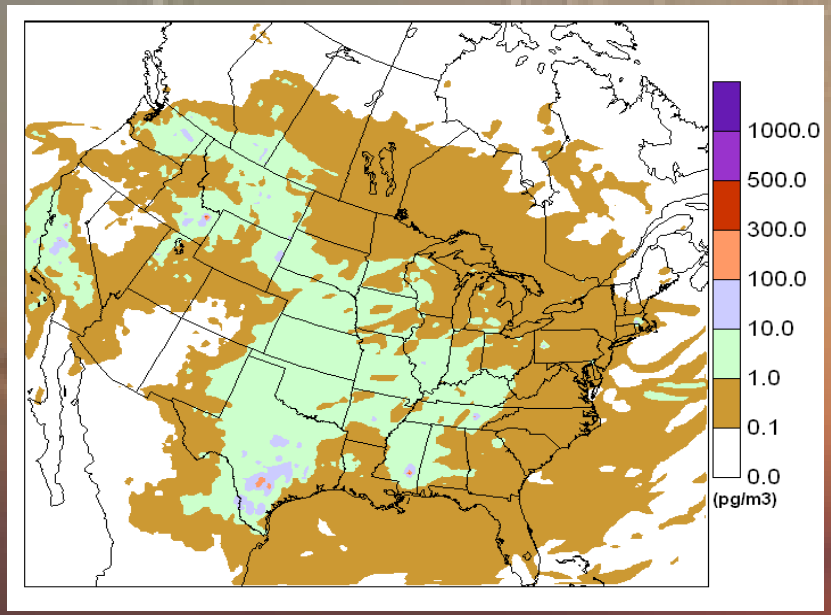
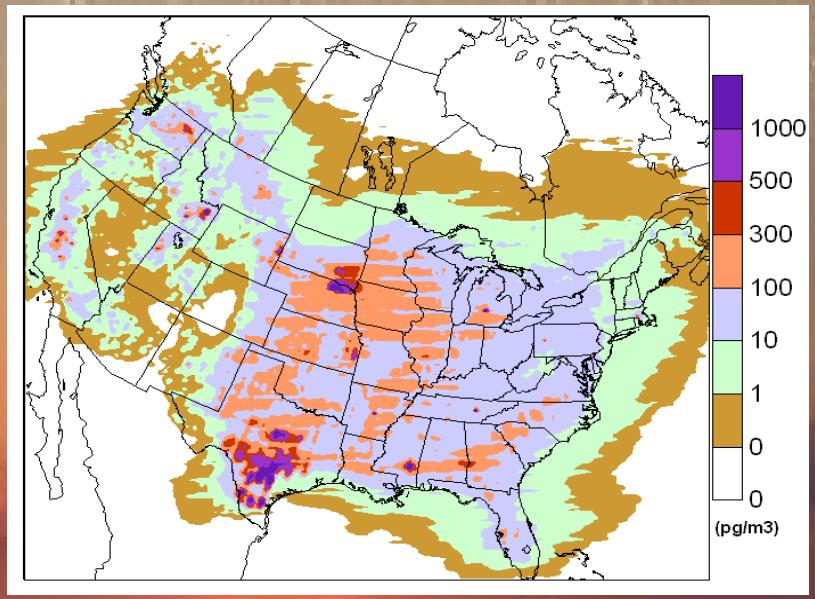




Old (left) and updated (right) HCB soil residues in agricultural lands in 2000





Modeled daily HCB air concentration at 1.5 m averaged over summer 2000 using old (left) and updated (right) HCB soil residues in agricultural lands

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Task 2: High resolution model run

Numerical Experiments setup: *4 scenarios*

Scenario 1. TRI air release data
Scenario 2. TRI air and land release data
Scenario 3. Soil residues from historical pesticides application
Scenario 4. Updated soil residues over agricultural land

Model run: from January 1st 2000 to January 1st 2002

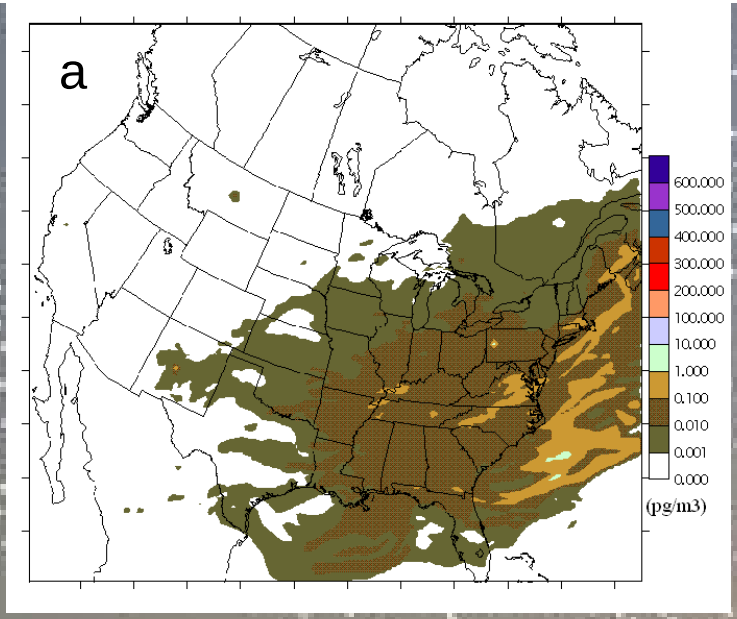
Initial condition:

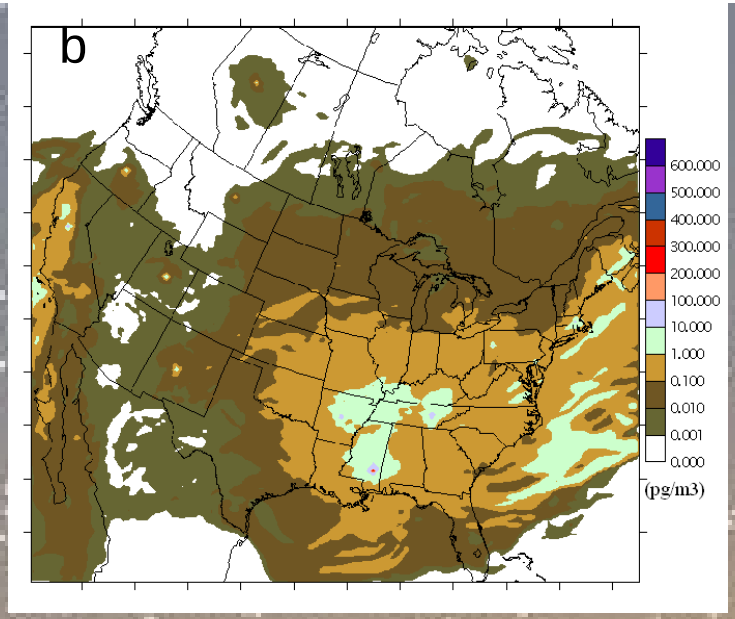
1 HCB air release data on a state level in the US was treated as area sources which were emitted continuously throughout the year

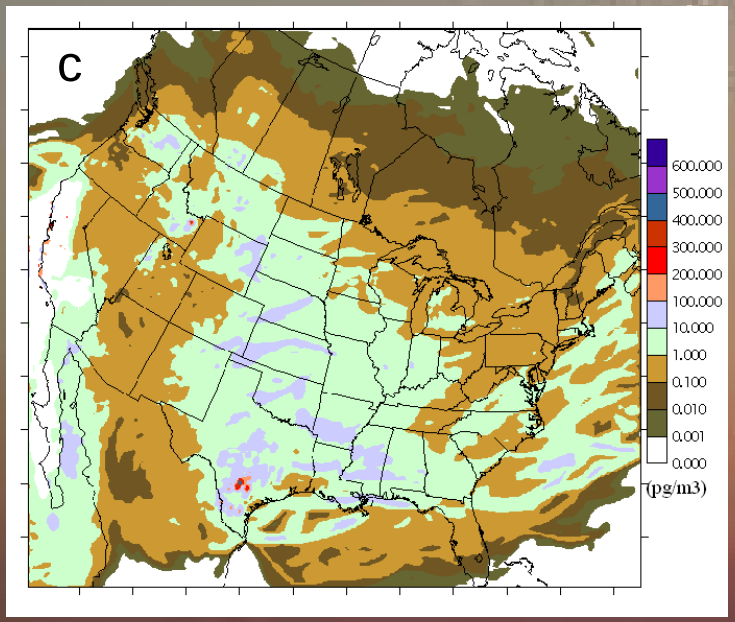
2 Land releases were assumed to be absorbed to soils and air releases were assumed to be deposited 100% to soils. Both releases data were added to form soil concentration

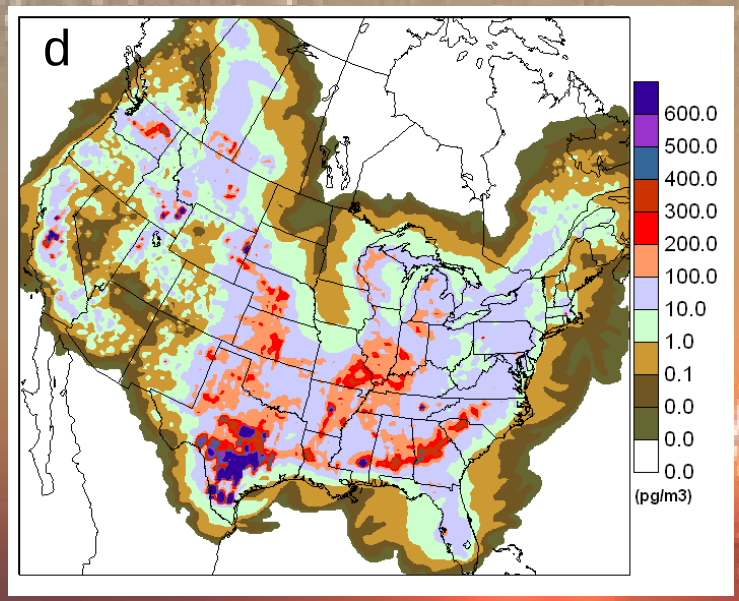
3 Soil residues from historical application of pesticides (HCB as a fungicide, atrazine, dacthal, lindane, Pentachloronitrobenzene…) in the US and Canada

4 Same as Scenario 3 but updating soil residues









Modeled HCB air concentration at 1.5 m averaged over summer 2001.

a.Scenario 1

b.Scenario 2

c.Scenario 3

d.Scenario 4

24 km x 24 km resolution, meteorological data from GEM

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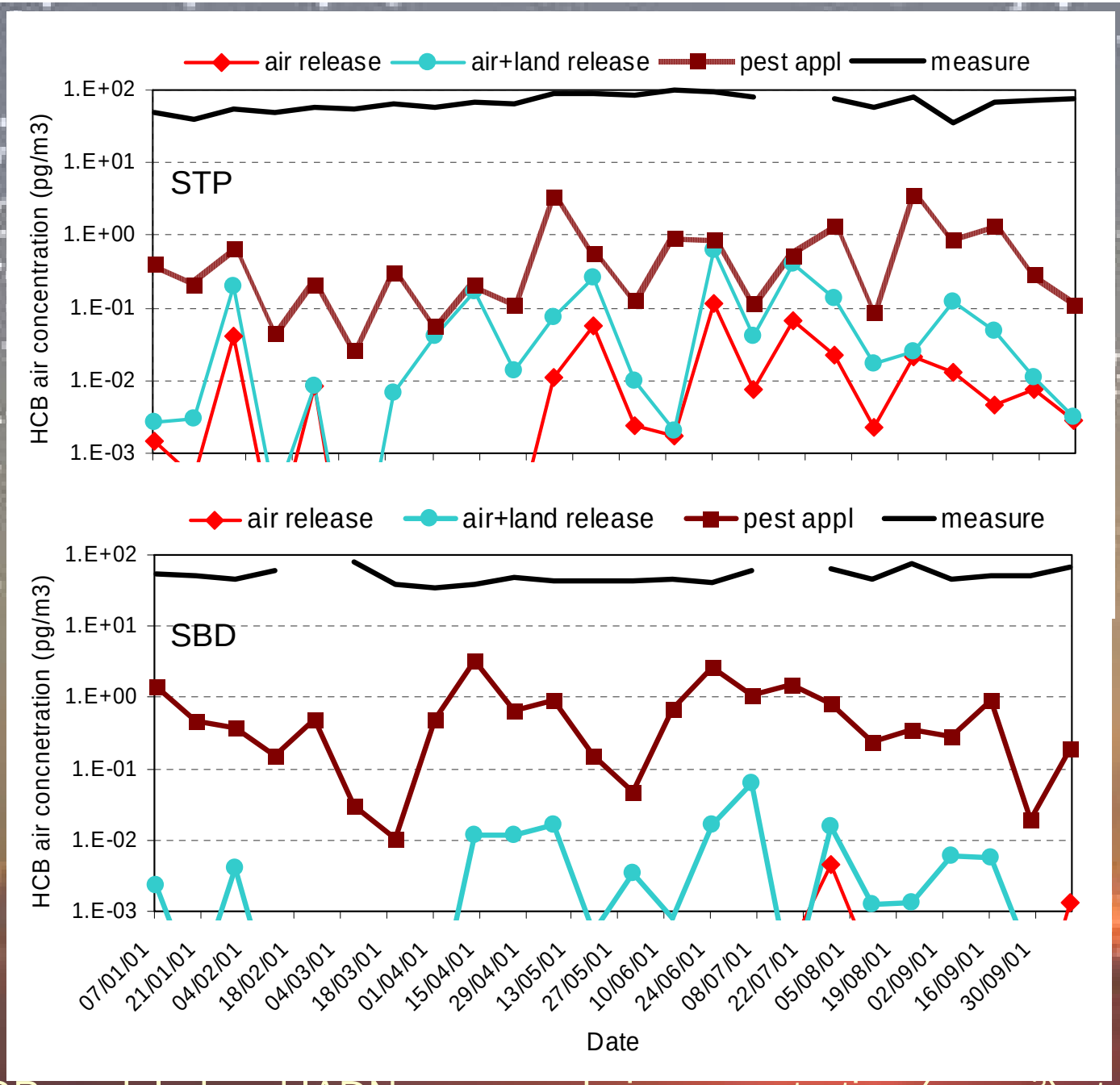

CanMETOP modeled and IADN measured air concentration (pg m^{-3}) at a: Sturgeon Point (STP, Lake Erie); b: Sleeping Bear Dune (SBD, Lake Michigan)

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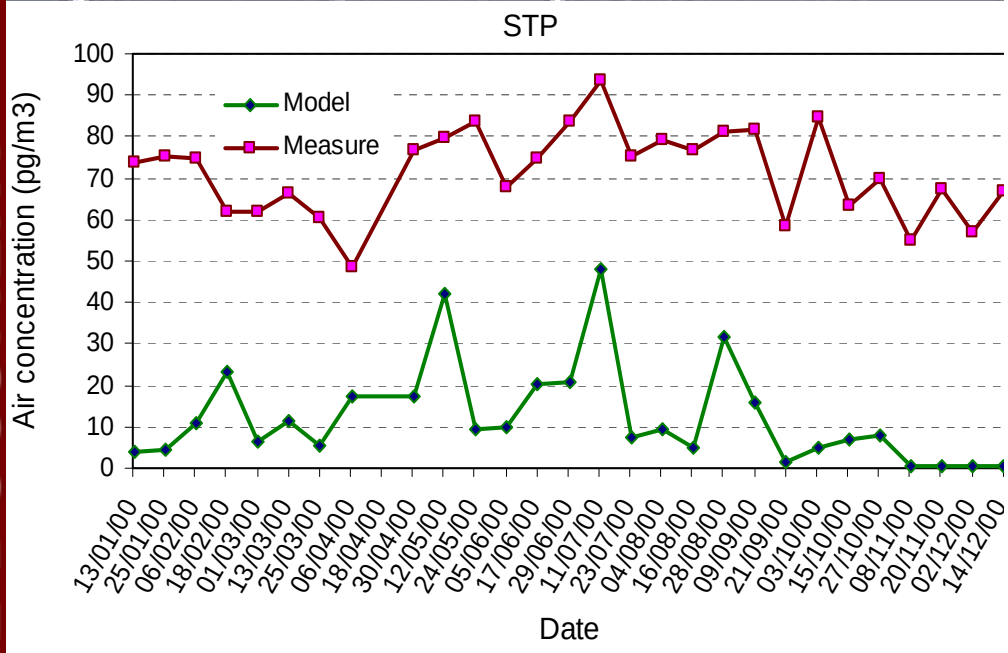
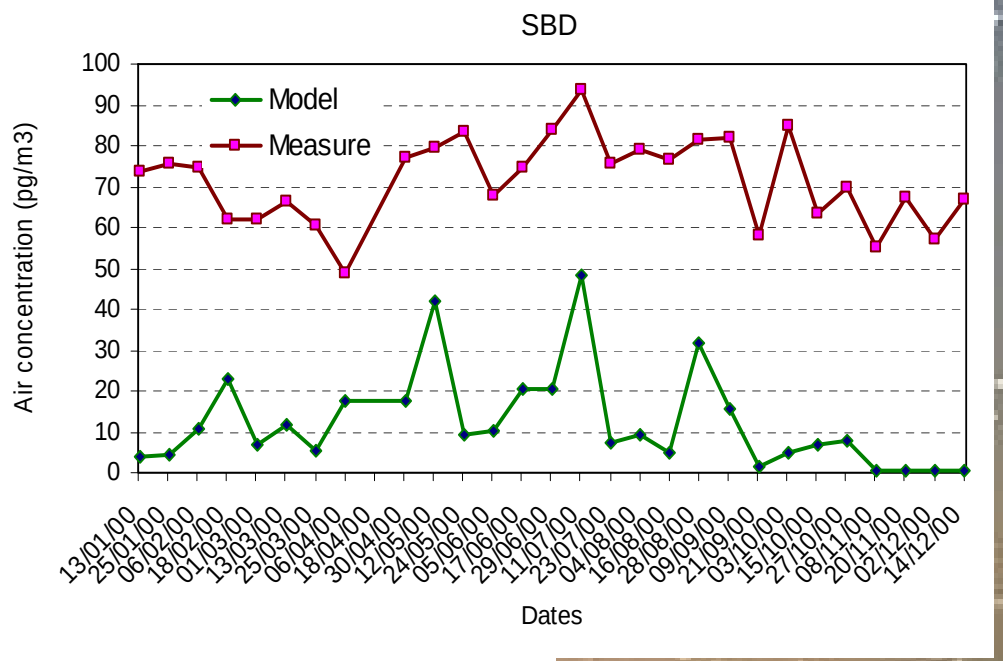
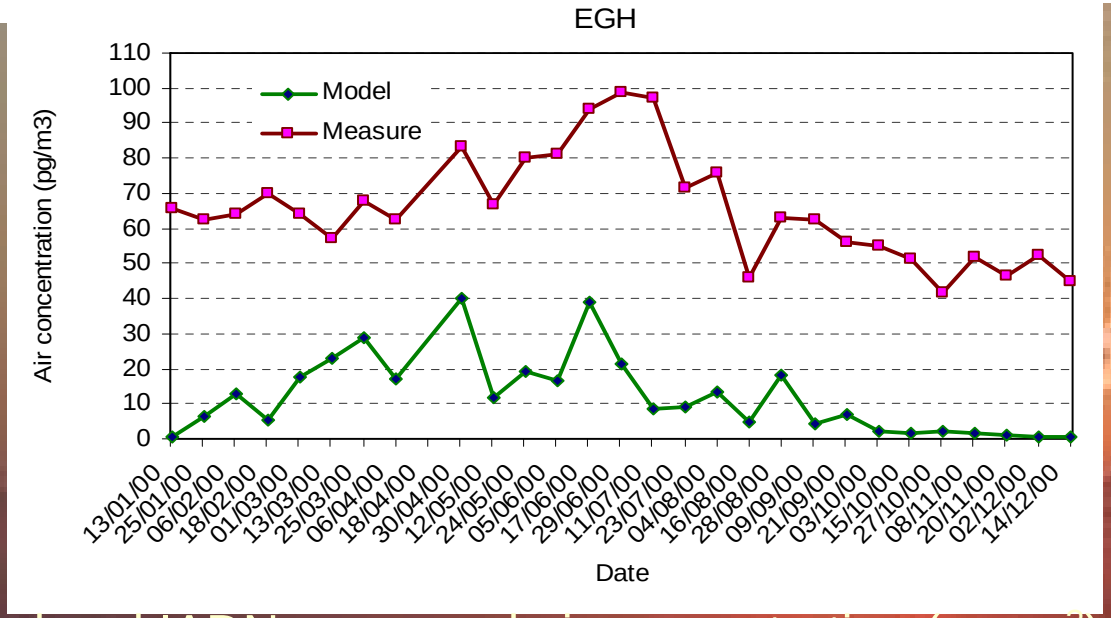
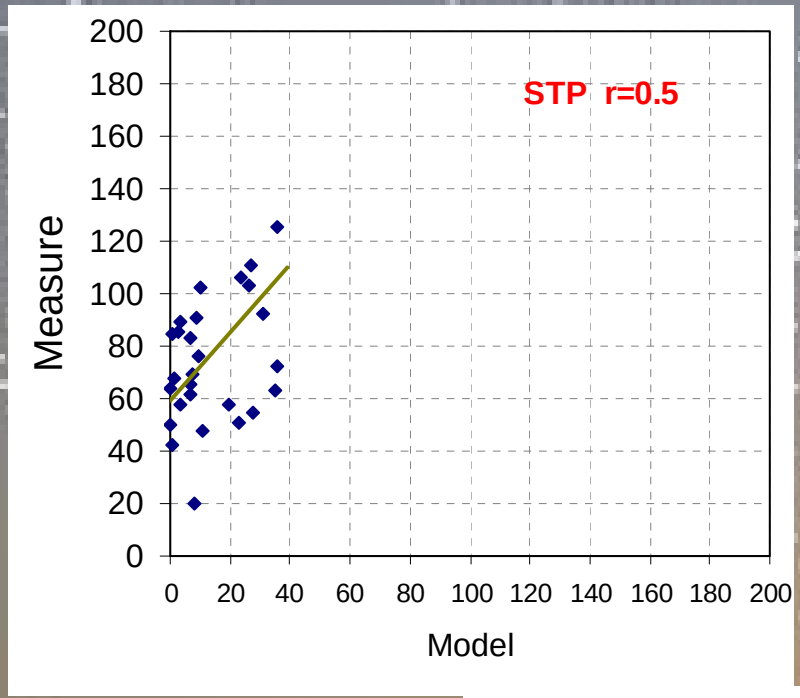


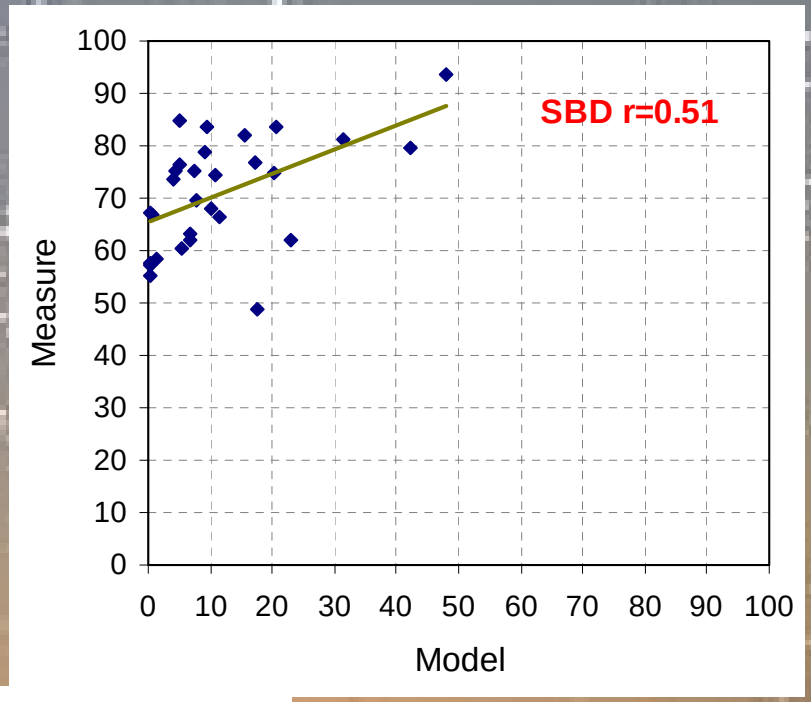


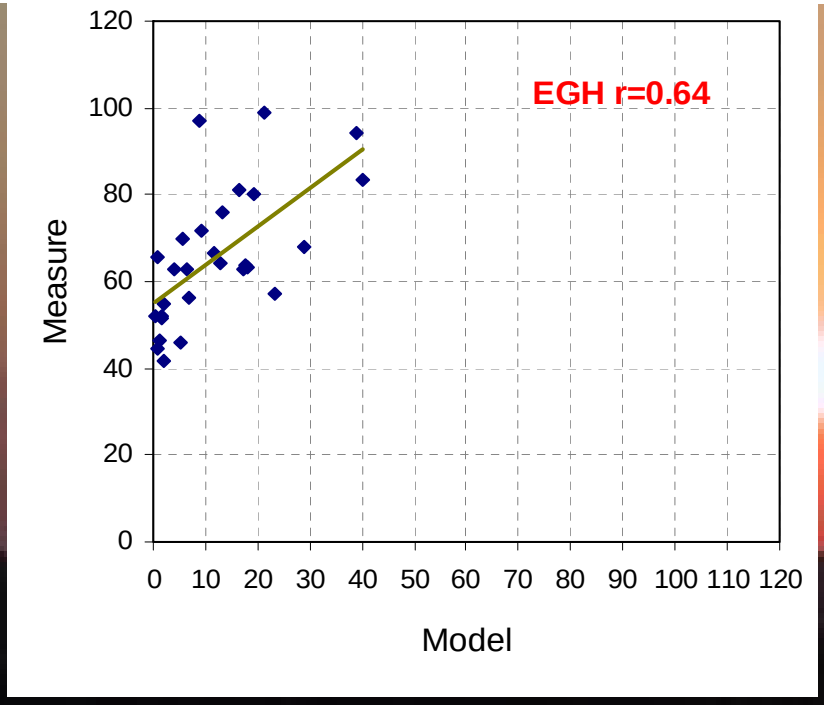


CanMETOP modeled and IADN measured air concentration (pg m^{-3}) in 2000 at STP (Lake Erie); SBD (Lake Michigan) and EGH (Lake Superior)

Comparing modeled and monitored air concentration







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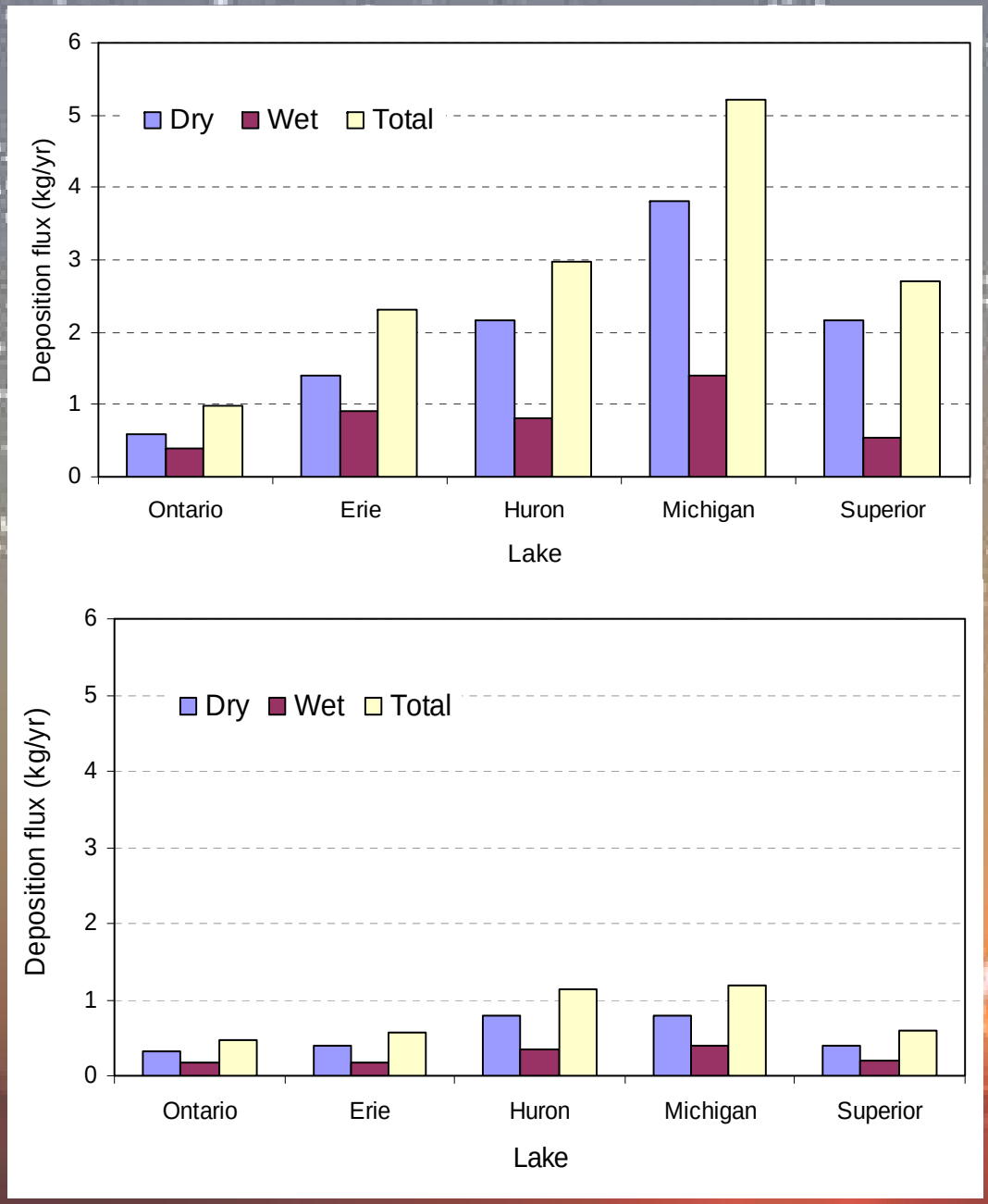
Wet deposition in 2000 (kg yr^{-1})

Superior	
Model	IADN
1.40	0.84

Michigan	
Model	IADN
0.55	0.99



Modeled annual dry and wet deposition fluxes (kg yr^{-1}) to the Great Lakes

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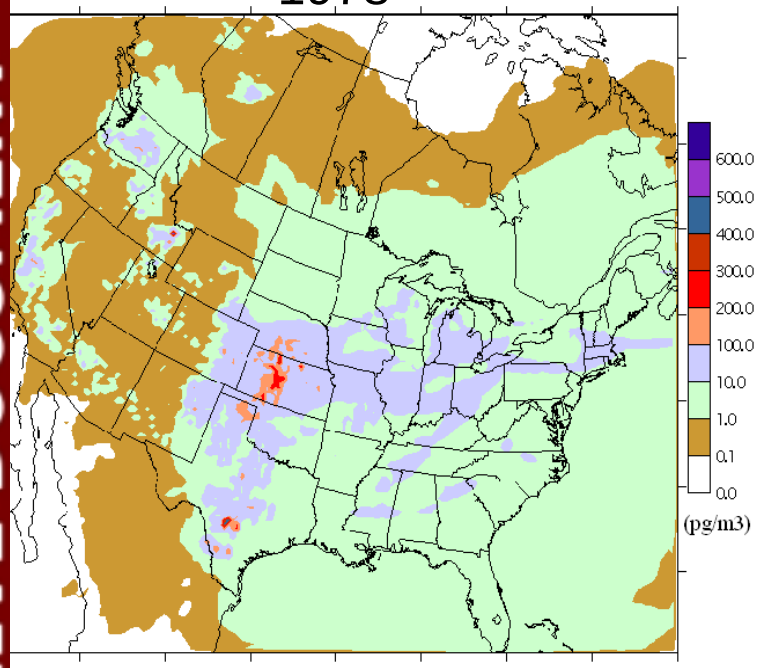
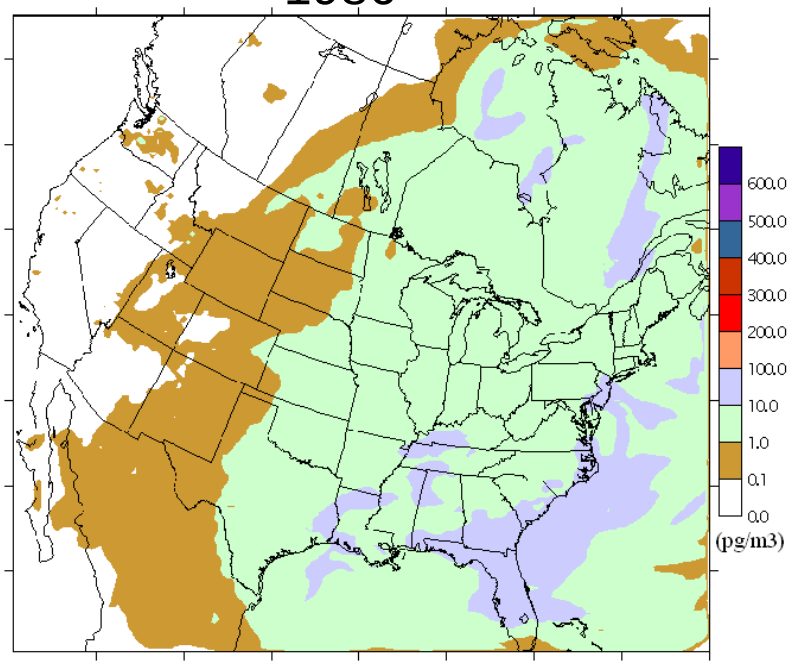
Task 3 26 years run from 1978-2003

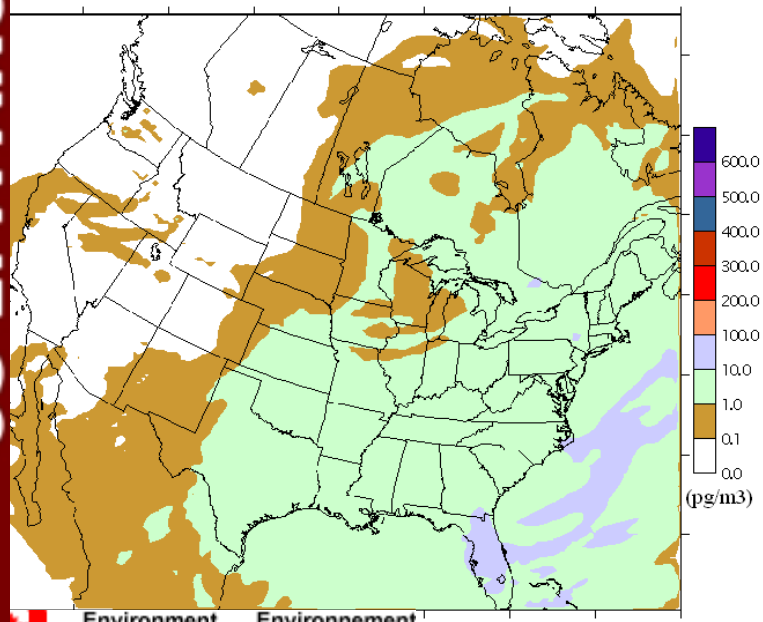
1978



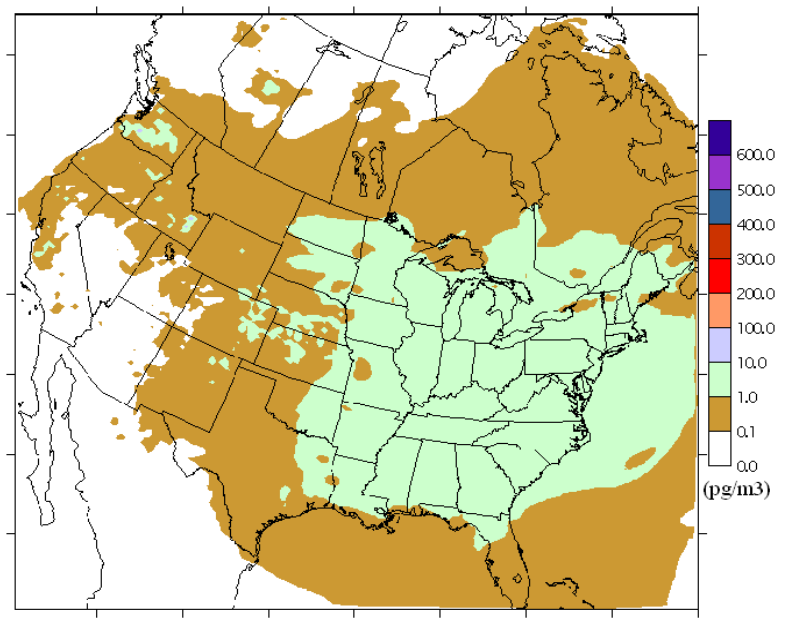
1986



1994



2002



35 km x 35 km resolution, meteorological data from NCEP reanalysis; soil residue data from pesticide application

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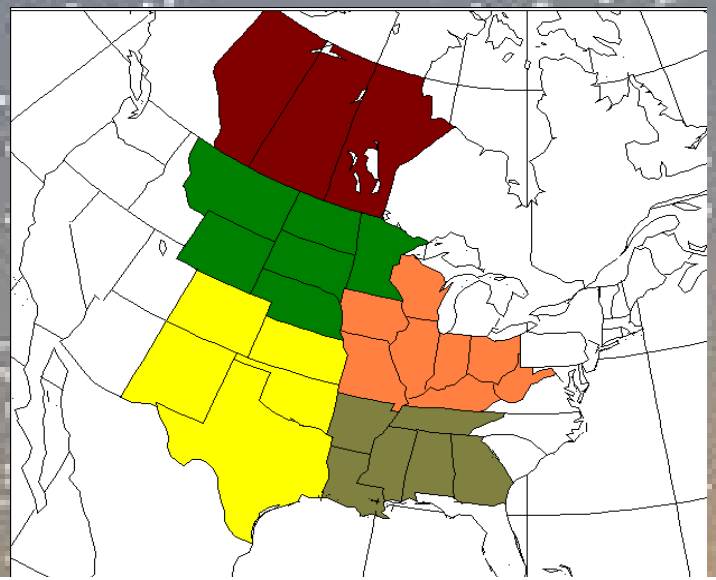
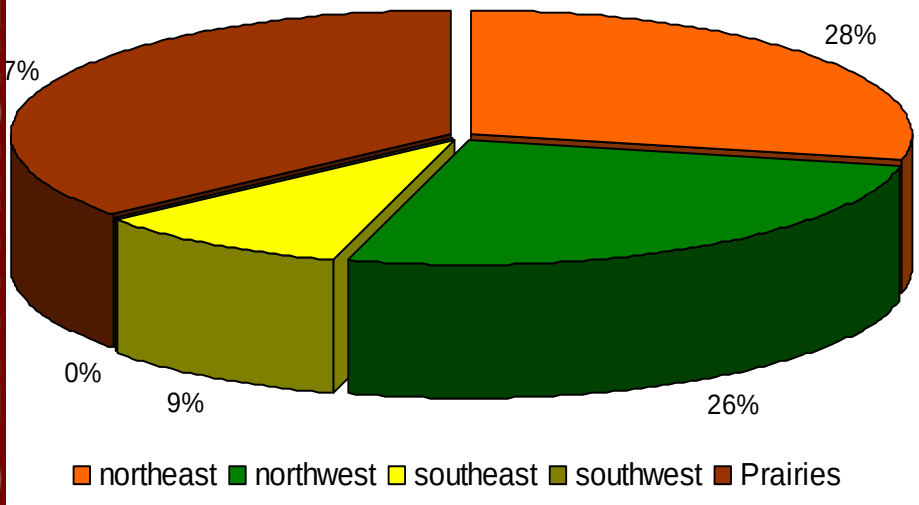
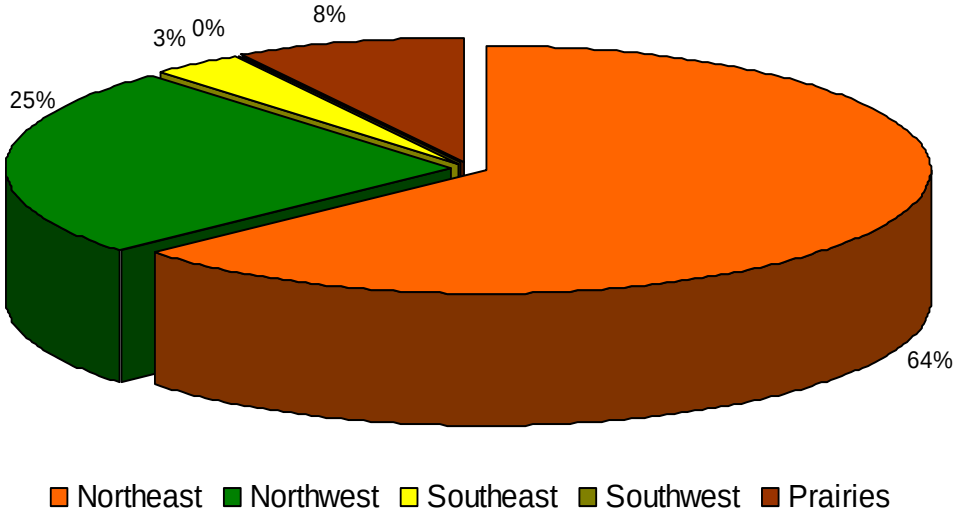
Task 4







Contribution of sources to air concentration over the Great Lakes

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Remaining work

- Complete computation of water/air exchange for 2000-2001
- Run CanMETOP for 1978-2003 using updated soil residue data
- Complete multiple scenario runs for assessing impact of sources on the GL in 2001
- Submit report of HCB project in April 2008

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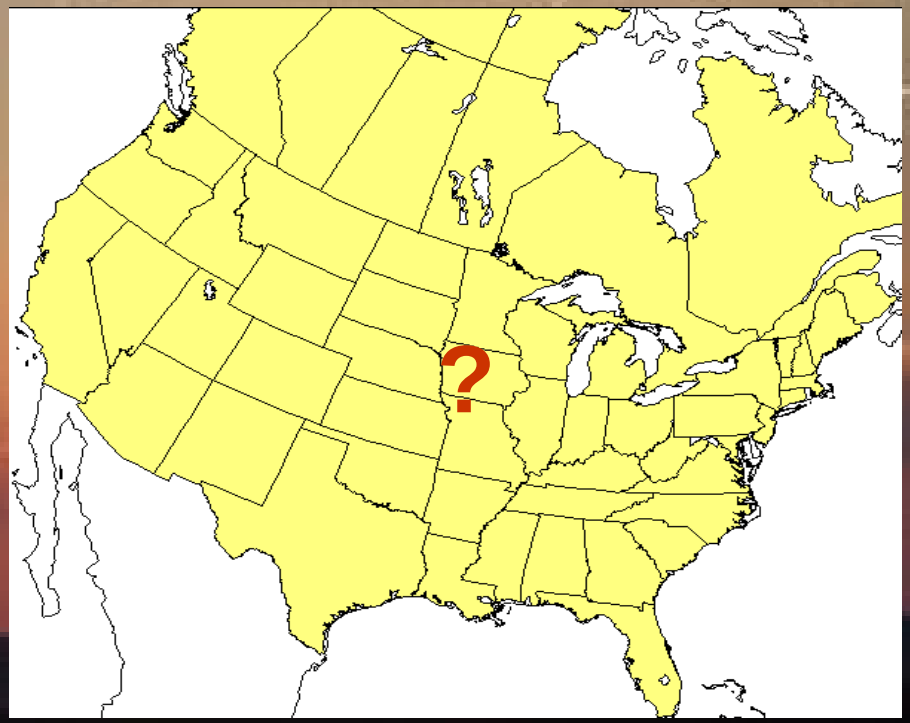
Further study: a proposal

US – Canada – China soil sampling, comparison, and atmospheric transport of HCB to the Great Lakes

- Collect 50 soil samples in China and 20 in North America
- Analyze HCB level in China and North America rural, urban and background soils
- Establish reliable HCB (and other toxics) soil emission inventory in NA and Asia
- Using regional- and global-scale CanMETOP to investigate regional and trans-Pacific transport of HCB and their impact on its budget over the Great Lakes



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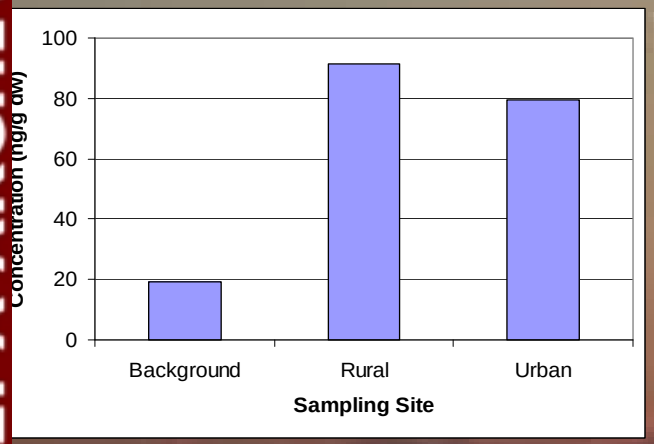
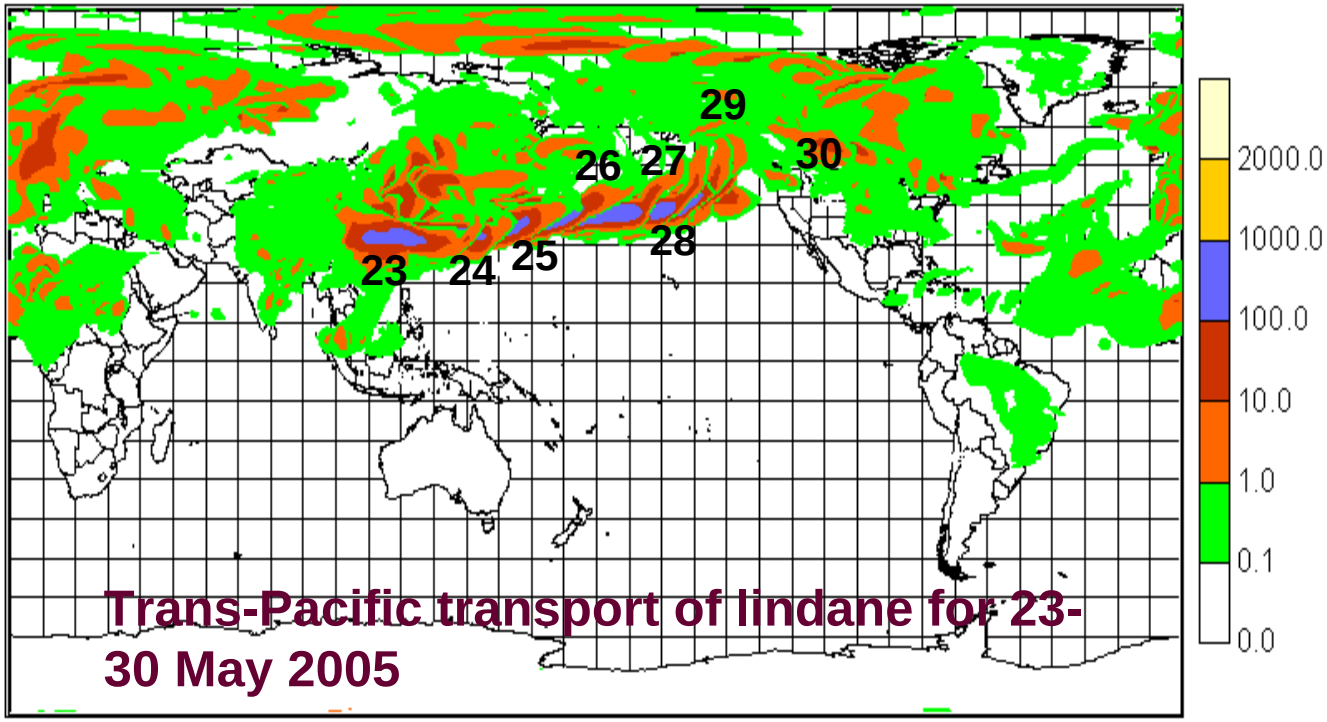
International Joint Research Center for Persistent Toxic Substances (IJRC-PTS) - Harbin Institute of Technology, China

- Canada - China Joint Project on Reduction of Lindane Usage in China and its Impact Globally and on North America
- IPY program: INCATPA



Mean concentration of HCB in Chinese urban, rural, and background soils in 2005



Trans-Pacific transport of lindane for 23-30 May 2005

Thank you